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Application Of 3D Models In Preoperative Planning Of Tibial Plateau Fractures: Can We Expect Changes?

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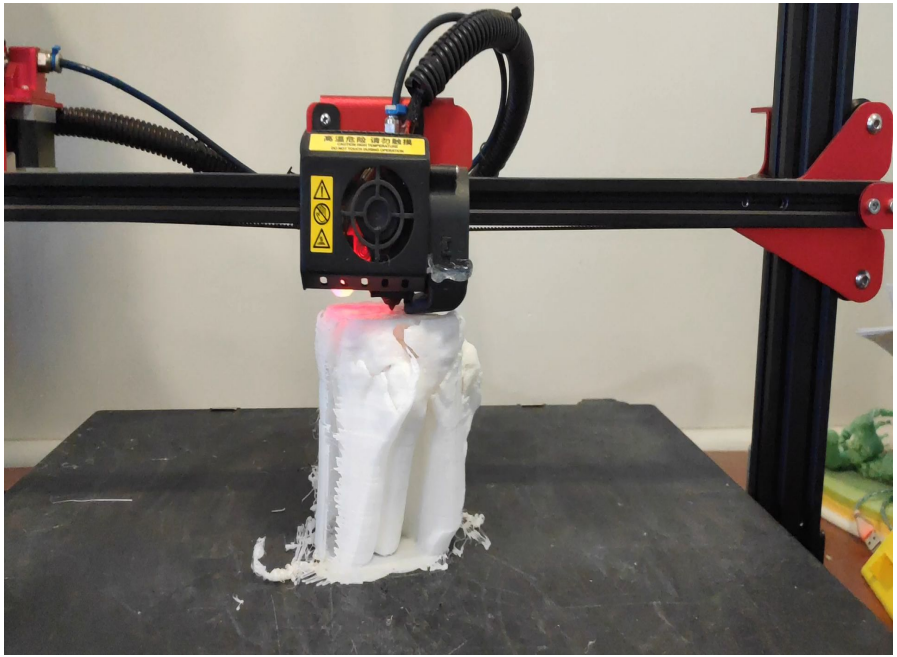
Disclosure

-Nothing to declare

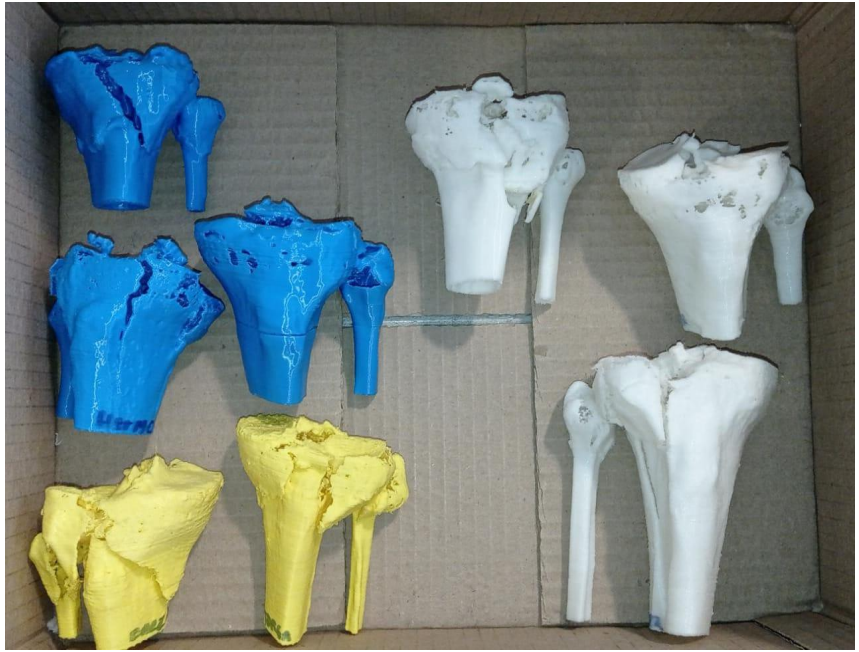
Introduction

-> Tibial plateau fractures are complex injuries, being in most cases of surgical management. (1)
-> These injuries require a good understanding of the fracture morphology, with surgical planning being essential, usually by computed tomography (CT). (2)
-> Nowadays, we have more advanced technologies, among which 3D printing stands out, which has shown great potential, especially in traumatology, demonstrating benefits in surgical planning, evidencing shorter surgical times, less blood loss, among other things. (3)



Objective

- Analyze the changes of preoperative planning in Tibial Plateau Fractures using 3D printing versus CT images.



Materials and Methods

-> Descriptive observational study

Inclusion criteria	Exclusion criteria
Fracture type Schatzker V and VI	Patients with no 3D reconstruction in their CT.
Patients from the same clinical center	
CT available in the imaging system DICOM	

-> Knee images of patients with Tibial Plateau fractures were extracted and their 3D printing was made for each case

Materials and Methods

-> Preoperative planning surveys were evaluated by knee surgeons.

(Number of plates, surgical approach, position on the table, use of bone graft)

Nombre
Años de Cirujano de Rodilla

Caso

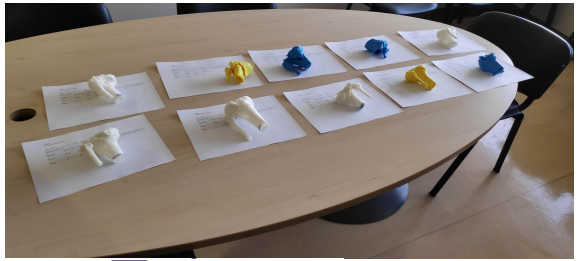
	1	2	3
Número de placas			

	Antero-medial	Medial	Postero-medial	Lateral	Postero-lateral	Posterior
Abordajes						

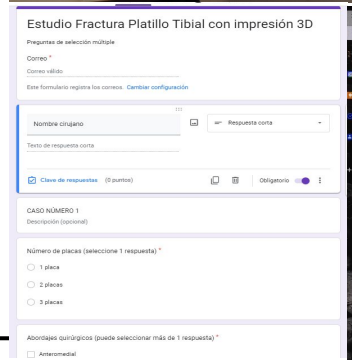
	Supino	Prono	Lateral
Posición			

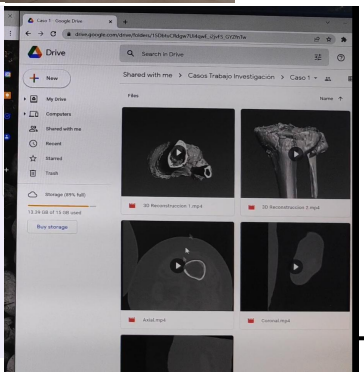
	Si	No
Injerto		

-> The survey was first carried out using the 3D printed models.



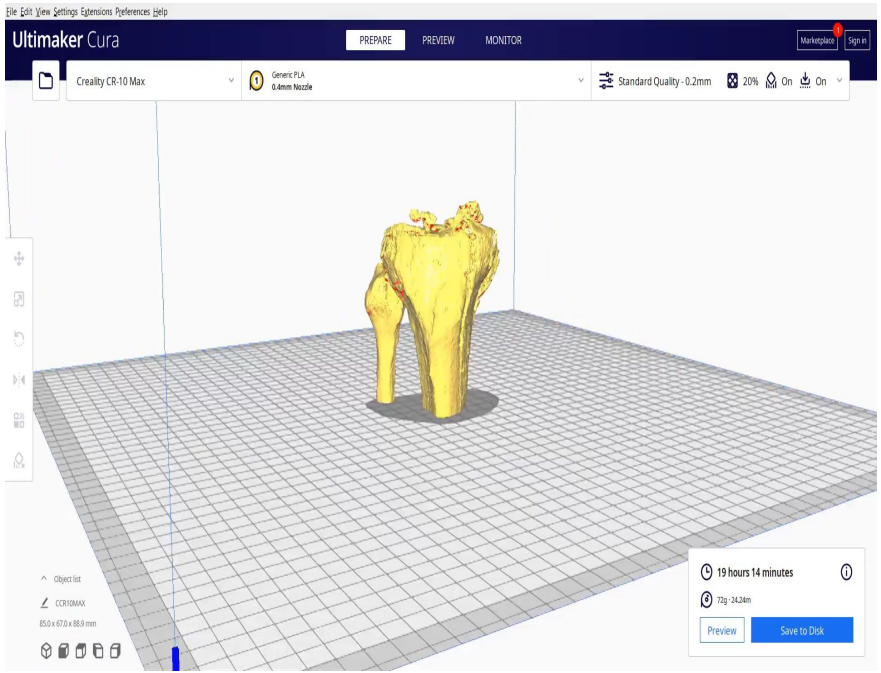
-> One week later, using the Google forms platform, this time with the CT scan and its respective 3D reconstruction.





Materials and Methods

-> A descriptive analysis was performed
-> Intraobserver variability was then calculated using the Cohen's Kappa Test
-> STATA v. 17.0 program was used for each independent variable and then for each full-case
-> “Agreement" in the full-case, was defined as the 4 variables of the same case without changes.



Results

->A total of 10 cases were included

-> Evaluators: 12 knee surgeons

-> Number of Plates: K=0,5 ⇒ Moderate

-> Surgical approach: K= 0,29 ⇒ Fair

-> Position on the table: K=0,81 ⇒ Almost Perfect

-> Use of bone graft: K=0,63 ⇒ Substantial

-> Full-case: K=0,25 ⇒ Fair

AGREEMENT MEASURES FOR CATEGORICAL DATA

Kappa Statistic	*Strength of Agreement*
<0.00	Poor
0.00–0.20	Slight
0.21–0.40	Fair
0.41–0.60	Moderate
0.61–0.80	Substantial
0.81–1.00	Almost Perfect

4. Landis J, Koch G: The measurement of observer agreement for categorical data. Biometrics 1977; 33: 159-74.

Discussion

-3D printing has shown explosive increase in number of orthopaedic publications in the last decade. (5)

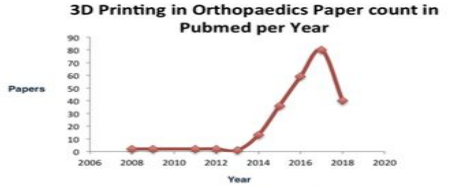


Fig. 1. An increasing trend in publications related to 3D printing in orthopedic surgery in Pubmed.

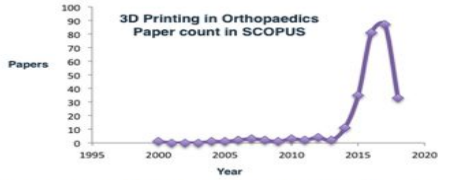


Fig. 2. An increasing trend in publications related to 3D printing in orthopedic surgery in SCOPUS.

-Demonstrated advantages in **intra** (less operation and tourniquet times, less blood loss) and **postop** results (improved reduction, faster union). (3, 6)

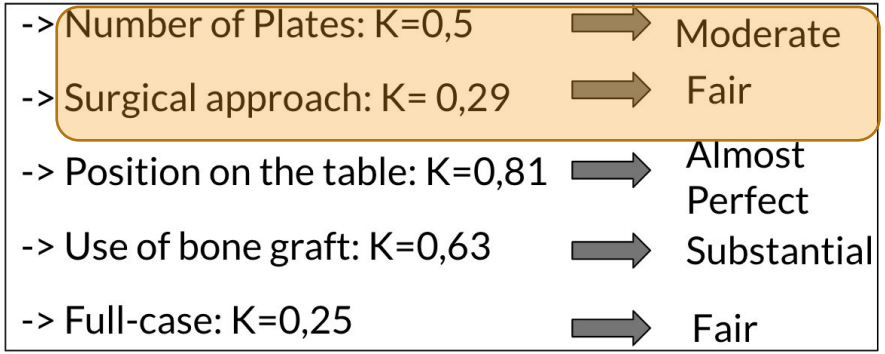
-No studies showing **preop** benefits in Tibial Plateau fractures

Discussion

Our study

Important changes in preoperative planning especially in number of plates and surgical approach

It shows to change at least one variable in most of the cases (K=0,25)

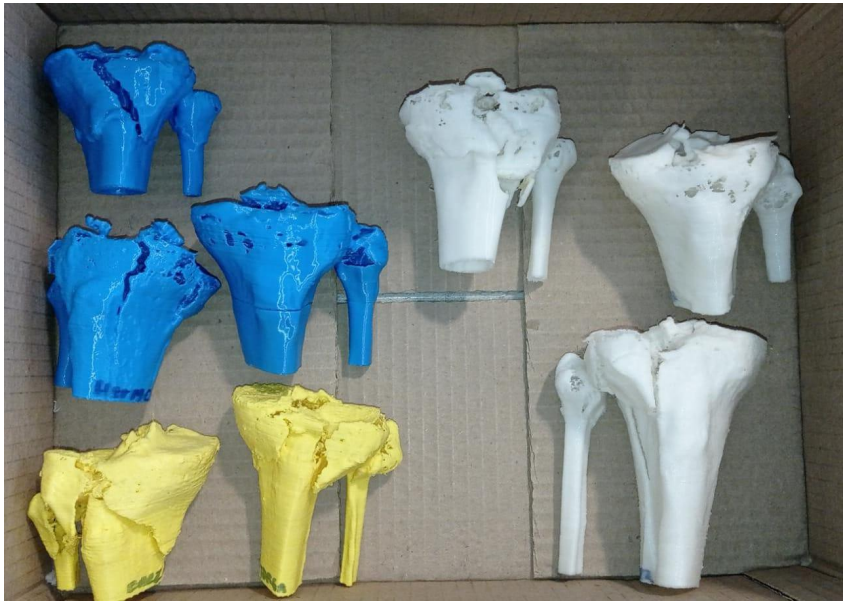


3D printing shows as another useful tool in the surgical planning of Tibial Plateau fractures

Conclusion

-> The use of 3D printing in the preoperative planning of Tibial Plateau Fractures, generates important changes, particularly in:

- Number of Plates
- Surgical approach



-> Generates less important changes in:

- Position over the table
- Use of Bone graft

References

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2. Shen S., et al. Pre-operative simulation using a three-dimensional printing model for surgical treatment of old and complex tibial plateau fractures. *Scientific Reports 10.1 (2020) 6044.*
3. Ozturk A., et al. Surgical advantages of using 3D patient-specific models in high energy tibial plateau fractures. *European Journal of Trauma and Emergency Surgery 46.5 (2020): 1183-1194.*
4. Landis J, Koch G: The measurement of observer agreement for categorical data. *Biometrics 1977; 33: 159-74.*
5. Vaishya R., et al. Publication trends and knowledge mapping in 3D printing in orthopaedics. *Journal of Clinical Orthopaedics and Trauma 9.3 (2018): 194-201.*
6. Xie L et al. Three-dimensional printing assisted ORIF versus conventional ORIF for tibial plateau fractures: A systematic review and meta-analysis. *Int J Surg. 2018 Sep;57:35-44. doi: 10.1016/j.ijsu.2018.07.012. Epub 2018 Aug 4. PMID: 30081183.*